Appl. Serial No. 10/632,153
Amendment dated July 5, 2005
Reply to Office Action dated November 9, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) Vessel propulsion system for propelling a vessel (2) in a given direction of propulsion (V), comprising:

(a) a vessel (2) adapted to float in water, thereby to define a waterline (W);

(b) propulsion means having operable and inoperable conditions, said propulsion means including a propulsion device (6) rotatably connected with said vessel at a location at which the propulsion device is immersed in the water, said propulsion device having an axis of rotation (10) that is generally normal to the direction of propulsion, said propulsion device having a circumferential surface;

(c) a cover (8) partially enclosing said propulsion device and cooperating with said circumferential surface to produce a water conveying flow channel in which water is conveyed continuously with said propulsion device when said propulsion device is in said operable condition, thereby fully removing any air that is included between said cover and said propulsion device when said propulsion device is in said inoperable condition [[.]]; and

(d) a pair of bounding elements (42, 43) bordering the sides of said propulsion device and extending beyond said circumferential surface to a location adjacent said cover.

2. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the propulsion device comprises a rotatably driven wheel (6).

3. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the propulsion device comprises a rotatably driven revolving belt.

4. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the propulsion device (6) exhibits a circumferentially closed circumferential surface.

5. Cancelled

6. (previously amended) Vessel propulsion system according to Claim 5, **characterized in that** the bounding elements and the cover are arranged stationarily.

7. (previously amended) Vessel propulsion system according to Claim 5, **characterized in that** the bounding elements (42, 44) are connected to the rotating propulsion device (6).

8. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the outer circumferential surface of the propulsion device (6) has several teeth (46) arranged one behind the other.

9. (previously amended) Vessel propulsion system according to Claim 8, **characterized in that** each tooth (46) has a leading edge (50) directed radially outwards

and a trailing edge (52) extending therefrom, directed radially inwards, and the leading edge (50) has a gradient lower than that of the trailing edge (52).

10. (previously amended) Vessel propulsion system according to Claim 9, **characterized in that** the tooth tip (48) of the teeth (46) is formed as a convex curvature in the axial direction.

11. (previously amended) Vessel propulsion system according to Claim 10, **characterized in that** at least one of the leading (50) and trailing (52) edges of the teeth (46) is formed as a convex curvature in the axial direction.

12. (previously amended) Vessel propulsion system according to Claim 11, **characterized in that** at least one of the leading (50) and trailing (52) edges of the teeth is formed as a convex curvature in the circumferential direction.

13. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** a rear end (14) of the cover (8) forming the inlet for the flow channel has a curvature directed forwards.

14. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the front end (12) of the cover forming the outlet for the flow channel has a curvature directed backwards.

15. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the upper edge of the cover (8) is arranged above the waterline

(W) of the vessel (2) and at least one of the front and rear ends (12, 14) of the cover (8) extends below the waterline (W).

16. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the cover extends with an enclosure angle of between 200° and 270° about the propulsion device (6).

17. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** between the propulsion device (6) and the cover a minimal gap (54) is formed of 2% to 10% of the diameter of the surrounding propulsion device (6).

18. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** the propulsion device (6) is, perpendicular to its axis of rotation (10), rotatable about a steering axis (S) and a control device is provided to control the rotation of the propulsion device (6) about the steering axis.

19. (previously amended) Vessel propulsion system according to Claim 18, **characterized in that** the propulsion device (6) together with the cover (8) are arranged on a support plate (68) through which the propulsion device (6) protrudes, whereby the upper surface of the support plate is sealed by a hood (34) and the support plate is accommodated in a pan (58) with an open bottom and such pan is rotatably supported in the vessel hull (16) and the propulsion device (6) protrudes through the pan (58) and a seal (72) is provided between the support plate (68) and the pan (58).

20. (previously amended) Vessel propulsion system according to Claim 19, **characterized in that** the hood (34) forms the cover (8).

21. (previously amended) Vessel propulsion system according to Claim 20, **characterized in that** the support plate (68) is, using at least one in-line inclination attenuator (82), supported on the pan (58) such that it can be pivoted.

22. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** a gap adjusting device is provided for adjusting the propulsion device relative to the cover.

23. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** it exhibits an immersion depth adjustment device for adjusting the height of the propulsion device and the cover.

24. (previously amended) Vessel propulsion system according to Claim 1, **characterized in that** a float (64) is provided on the front ends of the propulsion device (6) in each case and such float tapers down preferably in the axial direction of the axis of rotation (10), away from the propulsion device (6).

25. (previously amended) Vessel propulsion system according to Claim 24, **characterized in that** the floats (64) are supported in a freely rotatable manner on the axis of rotation (10) or on the drive shaft (22) of the propulsion device (6).

26. (previously amended) Vessel propulsion system according to Claim 25, **characterized in that** on the radial outer end of the propulsion device (6) a thickening (80) is provided which is connected to the propulsion device (6) and which covers the propulsion device (6) in a mushroom-head shaped manner and which, at least partially, circumferentially protrudes beyond the float (64).

27. (previously amended) Vessel propulsion system with a driven, toothed propulsion wheel, which dips partly into the water, the rotational axis of which essentially extends at right angles to the direction of propulsion of the vessel propulsion system, and with a cover partially circumferentially enclosing the propulsion wheel, the said cover being arranged in relation to the propulsion wheel (100) such that during operation of the vessel propulsion system a flow circulating in the rotational direction of the propulsion wheel forms between the circumferential surface of the propulsion wheel (100) and the cover, **characterized in that** the leading and trailing faces (104, 106) of each of the teeth (102) formed on the propulsion wheel exhibit a spherical, convex surface, the tooth tip of each tooth (102) is curved convexly in the axial direction and the starting point of the radii of curvature of the spherical surfaces and the contour of the tooth tip (112) are located in a plane extending orthogonally to the rotational axis of the toothed wheel, the said plane also including the center point of the propulsion wheel (100) in the axial direction.

28. (previously amended) Vessel propulsion system according to Claim 27, **characterized in that** the spherical surfaces and the tooth tip (112) have approximately the same radius of curvature.

29. (previously amended) Vessel propulsion system according to Claim 28, **characterized in that** the radii of curvature of the spherical surfaces and the tooth tip (112) vary at the most by 20% about a mean formed from the three radii of curvature.

30. (previously amended) Vessel propulsion system according to Claim 27, **characterized in that** the starting point of the radius of curvature of each of the trailing

faces (106) is essentially located on a circular shaped envelope area containing the tooth tips (112).

31. (previously amended) Vessel propulsion system according to Claim 27, **characterized in that** the starting point of the radii of curvature of each of the leading faces (104) is located on a circle which is situated concentrically to the rotational axis of the propulsion wheel (100) and between a circular area containing each tooth base (108, 110) and the rotational axis.

32. (previously amended) Vessel propulsion system according to Claim 31, **characterized in that** the radius of the circular area is 0.5 to 0.8 of the distance between the rotational axis and the envelope area containing the tooth base (108, 110).

33. (previously amended) Vessel propulsion system according to Claim 27, **characterized in that** the tooth tip (112) is spaced, with a perpendicular distance of 0.08 to 0.12 of the average mean of the three radii of curvature, from a radial line cutting the rotational axis and the tooth base (108) to the trailing face (106) of the corresponding tooth tip (112).

34. (previously amended) Vessel propulsion system with a driven, toothed propulsion wheel (100), which partly dips into the water, the rotational axis of which essentially extends at right angles to the propulsion direction of the vessel propulsion system and is arranged with a cover (126) partly enclosing the propulsion wheel (100) circumferentially such that with the operation of the vessel propulsion system a flow, circulating in the rotational direction of the propulsion wheel (100), is formed between the circumferential surface of the propulsion wheel (100) and the cover (126), especially

according to one of the previous claims, **characterized in that** gusset channels (140), which are formed between adjacent teeth of the propulsion wheel on its circumferential surface, open axially outwards to an intervening space (138) between the propulsion wheel (100) and the side surfaces (116, 118) of a housing (120) enclosing the propulsion wheel (100) and containing the cover (126).

35. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the leading and trailing faces (104, 106) are essentially formed the same geometrically and that the inlet and outlet apertures (128, 130) of the gap (132) are located at about the same height.

36. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the ratio of the volume of the intervening space (138) to the volume of the gap (132) is between 0.75 and 2.00.

37. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the distance between the side surfaces of the propulsion wheel (100) and the side surfaces (116, 118) of the housing corresponds at least to half the axial extension of the propulsion wheel (100).

38. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** a drive shaft (114) of the propulsion wheel (100) protrudes through the side surfaces (116, 118), which side surfaces carry bearings (12,124) for supporting the drive shaft (114).

39. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the cover (126) encloses the propulsion wheel (100) with an enclosure angle of between 200° and 300° and a region of the cover (126), forming the outlet aperture (130) for the flow in the main propulsion direction of the vessel propulsion system, encloses the propulsion wheel (100) so far that the flow is ejected mainly parallel to the propulsion direction, whereas a region of the cover (126) forming the inlet (128) of the hydrodynamic drive for the flow in the main drive direction draws in the flow essentially with a speed extending perpendicular to the propulsion direction into a gap (132) formed between the cover (126) and the circumferential surface of the propulsion wheel (100) and that the propulsion wheel (100) exhibits ring-shaped cheeks (136) protruding beyond the tooth base (108) on both of its face sides.

40. (previously amended) Vessel propulsion system according to Claim 39, **characterized in that** the cheeks (136) extend to about the highest point of the tooth tips (112).

41. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the gap (132) in the region of the outlet aperture (130) tapers in the main direction of propulsion.

42. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the gap in the region of the inlet aperture (128) is widened funnel-shaped.

43. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the gap (132) has a constant gap height over 90% to 95% of the enclosure angle essentially in the circumferential direction.

44. (previously amended) Vessel propulsion system according to Claim 34, **characterized in that** the gap (132) in its section constant in the circumferential direction, measured from the radially outermost point of the tooth tip (112), has a height to the cover (126) of 0.08 to 0.12 of the mean of the three radii of curvature.

45. (previously amended) Vessel propulsion system with a driven, toothed propulsion wheel (100), which partly dips into the water, the rotational axis of which essentially extends at right angles to the propulsion direction of the vessel propulsion system and is arranged with a cover (126) partly enclosing the propulsion wheel (100) circumferentially such that with the operation of the vessel propulsion system a flow, circulating in the rotational direction of the propulsion wheel (100), is formed between the circumferential surface of the propulsion wheel (100) and the cover (126), particularly according to one of the previous claims, **characterized in that** gusset channels (140), which are formed between adjacent teeth of the propulsion wheel on its circumferential surface, open axially outwards to an intervening space (138) between the propulsion wheel (100) and the side surfaces (116, 118) of a housing (120) enclosing the propulsion wheel (100) and containing the cover (126), the leading and trailing faces (104, 106) of each of the teeth (102) formed on the propulsion wheel exhibit a spherical, convex surface, the tooth tip of each tooth (102) is curved convexly in the axial direction and the starting point of the radii of curvature of the spherical surfaces and the contour of the tooth tip (112) are located in a plane extending orthogonally to the rotational axis

of the toothed wheel, the said plane also including the center point of the propulsion wheel (100) in the axial direction.

46. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the spherical surfaces and the tooth tip (112) have approximately the same radius of curvature.

47. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the radii of curvature of the spherical surfaces and the tooth tip (112) vary at the most by 20% about a mean formed from the three radii of curvature.

48. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the starting point of the radius of curvature of each of the trailing faces (106) is essentially located on a circular shaped envelope area containing the tooth tips (112).

49. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the starting point of the radii of curvature of each of the leading faces (104) is located on a circle which is situated concentrically to the rotational axis of the propulsion wheel (100) and between a circular area containing each tooth base (108, 110) and the rotational axis.

50. (previously amended) Vessel propulsion system according to Claim 49, **characterized in that** the radius of the circular area is 0.5 to 0.8 of the distance between the rotational axis and envelope area containing the tooth base (108, 110).

51. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the tooth tip (112) is spaced, with a perpendicular distance of 0.08 to 0.12 of the average mean of the three radii of curvature, from a radial line cutting the rotational axis and the tooth base (108) to the trailing face (106) of the corresponding tooth tip (112).

52. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the leading and trailing faces (104, 106) are essentially formed the same geometrically and that the inlet and outlet apertures (128, 130) of the gap (132) are located at about the same height.

53. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the ratio of the volume of the intervening space (138) to the volume of the gap (132) is between 0.75 and 2.00.

54. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the distance between the side surfaces of the propulsion wheel (100) and the side surfaces (116, 118) of the housing corresponds at least to half the axial extension of the propulsion wheel (100).

55. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** a drive shaft (114) of the propulsion wheel (100) protrudes through the side surfaces (116, 118), which side surfaces carry bearings (12,124) for supporting the drive shaft (114).

56. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the cover (126) encloses the propulsion wheel (100) with an enclosure angle of between 200° and 300° and a region of the cover (126), forming the outlet aperture (130) for the flow in the main propulsion direction of the vessel propulsion system, encloses the propulsion wheel (100) so far that the flow is ejected mainly parallel to the propulsion direction, whereas a region of the cover (126) forming the inlet (128) of the hydrodynamic drive for the flow in the main drive direction draws in the flow essentially with a speed extending perpendicular to the propulsion direction into a gap (132) formed between the cover (126) and the circumferential surface of the propulsion wheel (100) and that the propulsion wheel (100) exhibits ring-shaped cheeks (136) protruding beyond the tooth base (108) on both of its face sides.

57. (previously amended) Vessel propulsion system according to Claim 56, **characterized in that** the cheeks (136) extend to about the highest point of the tooth tips (112).

58. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the gap (132) in the region of the outlet aperture (130) tapers in the main direction of propulsion.

59. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the gap in the region of the inlet aperture (128) is widened funnel-shaped.

60. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the gap (132) has essentially a constant gap height over 90% to 95% of the enclosure angle in the circumferential direction.

61. (previously amended) Vessel propulsion system according to Claim 45, **characterized in that** the gap (132) in its section constant in the circumferential direction, measured from the radially outermost point of the tooth tip (112), has a height to the cover (126) of 0.08 to 0.12 of the mean of the three radii of curvature.